GUIDELINES FOR USING PRESCRIBED FIRE TO MANAGE SAGEBRUSH COMMUNITIES IN OCCUPIED SAGE GROUSE HABITATS OF WYOMING

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ABSTRACT

It is estimated that over 94 million acres of the western United States are dominated by various sagebrush species and approximately 58,000 square miles (37 million acres) of Wyoming are covered by thirteen different types of sagebrush. Such sagebrush communities evolved as dynamic landscapes with climatic and edaphic variation driving changes in fire frequencies, and in adaptive development of different sagebrush species. Investigations indicate the historic sagebrush-steppe ecosystem was a mosaic of successional (age) classes created and maintained by fire regimes ranging in frequency from 10-110 years depending on sagebrush species and specific geographic area. The diversity and juxtaposition of sagebrush community type, age class and associated vegetative community types provide habitat for approximately 87 species of mammals, 297 species of birds and 63 species of fish, reptiles and amphibians. Human-induced fire suppression and repetitive livestock herbivory can lead to successionally advanced or subclimax stages across the landscape. Prescribed fire, wildland fire use, and herbivory management are effective tools available to managers for maintaining and enhancing sagebrush types and associated communities. Treatment prescriptions must be carefully designed and tailored to the species, subspecies and varieties of sagebrush targeted. This paper provides recommendations for landscape-scale management of Wyoming big sagebrush (*Artemisia tridentata wyomingensis),* mountain big sagebrush (*Artemisia tridentata vaseyana pauciflora),* and Vasey big sagebrush (*Artemisia tridentata vaseyana vaseyana)* within occupied sage grouse habitats of Wyoming.

INTRODUCTION

The historical presence of sagebrush in the west has been well documented through numerous paleontological studies. Pollen records near Grays Lake, Idaho indicate dense sagebrush stands were preserved well over 35,000 years ago (Beiswenger 1987). Beetle and Johnson (1982) estimated that 58,000 square miles (37 million acres) of Wyoming are covered by thirteen different types of sagebrush. A mix of shrubs and herbaceous plants in sagebrush and associated communities provide a diverse habitat for approximately 87 species of mammals, 297 species of birds and 63 species of fish, reptiles and amphibians (Braun et al. 1976; WGFD Vertebrate Species List 1992). Investigations indicate the historic sagebrush-steppe ecosystem was a mosaic of successional (age) classes created and maintained by fire regimes ranging in frequency from 10-110 years depending on sagebrush species and specific geographic area. After investigating fire episodes in the Interior Columbia Basin Ecosystem from 1540 to 1940, Barnett et al (1997) concluded that 4% (4 million acres) of the Columbia Basin sagebrush types burned annually. In some areas mosaics of different seral stages have changed to rather homogenous stands of dense sagebrush with corresponding reductions in herbaceous understory species as a result of fire suppression and livestock influence. (Winward, 1985; Kauffman, 1990; Young 1990; Crawford 1992; Wright and Bailey 1982; Champlin and

Winward 1982; Hironaka et al. 1983; Crane and Fisher 1986; Tart 1996; Goodrich 1999). Moreover, active fire suppression and improper livestock grazing in Wyoming have contributed to denser, more monotypic stands of sagebrush, reduction of herbaceous understories, and simplification of community diversity (Bennett 1999). Sagebrush has both a lateral and tap root system which makes it very efficient in terms of water/nutrient uptake. Thus, as stands become more dense or during times of stress, sagebrush easily dominates over herbaceous species. Other factors disrupting sagebrush successional dynamics include soil and water depletion, exotic plant invasion, agricultural type conversions, and industrial developments.

Many other plant communities (e.g., aspen, mountain shrubs, salt desert shrubs, open conifer) occur in association with sagebrush communities (e.g. intra an inter-community associations). Such communities are important to a myriad of aquatic and terrestrial wildlife species. Recent investigations in Wyoming indicate these associated communities are also in advanced successional and/or subclimax states. These communities are also dynamic versus static, and perturbations (i.e. fire) are necessary for their long-term maintenance.

The supply of water available to aquatic-species is controlled by precipitation and regulated by interactions among geology, soils, and vegetation. Optimal management to restore seeps, springs, riparian type stability, bank storage, and base stream flows entails maintaining or increasing the total volume of water captured, stored, and released in a watershed. A landscape of predominately late seral stages with heavy densities of sagebrush canopies will limit efforts to retain or restore optimal watershed dynamics, and, in turn, native trout, other aquatic-species, and recreational fishing opportunities.

Many remaining populations of native trout (e.g., Colorado River, Bonneville, and Yellowstone cutthroat trout-subspecies) are dependant on the water resources derived from sagebrush-associated landscapes. In Wyoming, each of these trout-subspecies has been petitioned for listing as threatened or endangered species. Most genetically pure strains of these subspecies have been displaced to, or isolated as small populations in smaller order, headwaters streams draining landscapes with some proportion of sagebrush types. Prescribed fire and other management tools can be used to maintain and/or enhance base stream flows for these species.

Sage grouse populations in the Lander, Green River, and Pinedale regions, as well as some surrounding areas, have historically been some of the largest in Wyoming. This is due to the presence of large tracts of sagebrush often occupying hundred or thousands of acres. Some of these sagebrush communities are covered by dense, old-age, moderately to heavily hedged, monotypic stands lacking a diverse, productive grass/forb understory. Holloran=s (2000) radio tracking data of 318 radio-years for female sage grouse throughout Wyoming indicate sage grouse select against interiors of extensive stands of monotypic, mature sagebrush, preferentially selecting edges of those habitats. This indicates that patchy openings that create mosaics within huge expanses of sagebrush can be beneficial to sage grouse. There certainly

are large scale habitat losses occurring from industrial development that are a concern in these areas and domestic grazing practices and drought have probably strongly influenced existing habitat conditions. However, there are also opportunities to enhance sage grouse habitat using appropriate prescribed fire prescriptions. Prior to conducting any treatment it is essential to identify the sagebrush species/subspecies/variety, understand it=s ecology and fire effects, and establish treatment objectives. This should be done with input and planning from biologists with sagebrush and sage grouse expertise.

The landscape goal for sagebrush systems is to maintain a mosaic of age classes and canopy covers across large continuous stands. Sagebrush communities provide vital habitat for many of Wyoming=s wildlife species. Activities directed at controlling, eradicating, or otherwise reducing the sagebrush acreage in Wyoming are not condoned.

ECOLOGY AND TREATMENT RECOMMENDATIONS FOR WYOMING BIG SAGEBRUSH (*Artemisia tridentata* ssp. *wyomingensis*).

Fire intervals in *Ar. tr. wyomingensis* probably ranged from 50-110 years in the more xeric sites and recovery to 20% canopy cover from a burn may take >40 years (Winward, 1991). The maximum canopy cover that can normally be expected for Wyoming big sagebrush (*Ar. tr. wyomingensis*) in the 8-10 inch precipitation zone is normally 25-30%. At canopy coverage of 12-15%, competition begins to decrease the understory herbaceous component (Goodrich et al . 1999, Winward 1991, Tuller & Blackburn 1974). Goodrich (1999), estimates a 3.8% decrease in understory herbaceous production for every 1% increase in *Ar. tr. wyomingensis* canopy cover over 15%. Forbs generally play a lesser role in community dynamics of *Ar. tr. wyomingensis*. These communities are more important as winter range. Goodrich et al (1999) and Rittenhouse and Sneva (1976), recommend the following desired conditions for ecological functions: 5-15% canopy cover, > 50% ground cover, 4-12 forbs present in a 100 ft. radius plot. Additionally, Heath (1996) recommended maintaining average residual grass stubble height between 10-15 cm for potential *Ar. tr. wyomingensis* nesting habitat in Wyoming.

Long-term Management Objectives for *Ar. tr. wyomingensis* on a landscape scale

- A general objective is to treat 15% of the treatable sagebrush community every 10 years (i.e. 75% of the community every 50 years).
- 25% of the area untreated - in general and on a landscape scale approximately 25% of the area did not historically lend itself to periodic burning (i.e. ridge tops, xeric sites, etc.)
- 10% of the area with 0-5% sagebrush crown cover and/or 0 - 15 yr. old plants
- 25% of the area with 5-15% canopy cover and/or 15-30 yr. old plants
- 40% of the area with >15% canopy cover and/or > 30 yr. old plants
- maintain residual grass stubble height between 10-15 cm in all potential sage grouse nesting sites
- maintain a mean of 15 species of vascular plants in stands having 11-20% sagebrush canopy cover
- maintain ground cover >60% (except in recently treated areas - should be approaching 60% within three years post treatment).
- burn only after good seed production years (Sagebrush seed viability is short lived. Burning after two years of poor seed production will greatly retard re-establishment.)

ECOLOGY AND TREATMENT RECOMMENDATIONS FOR VASEY BIG SAGEBRUSH (*Artemisia tridentata* ssp. *vaseyana* var. *vaseyana)* AND MOUNTAIN BIG SAGEBRUSH (*Artemisia tridentate* ssp. *vaseyana* var. *pauciflora*).

The landscape goal is to maintain a mosaic of age classes, and canopy covers across large continuous stands of sagebrush in Wyoming. Canopy cover for *Ar. tr .va. vaseyana* usually ranges from 14-41% with most stands occurring in western Wyoming falling in the 22-29% and many in the 30-35% (Winward 1991, Tart 1996). Optimum ecological conditions exist at cover values between 15-20%, after which the herbaceous component declines (Bunting et al. 1987). Number of herbaceous species in the understory in western Wyoming ranged from 11-39, with a mean of 27. *Ar. tr. va. vaseyana* had a natural fire frequency of 10-30 years and usually returns to preburn density and canopy cover in 15-20 yr. (Bunting et al. 1987, Champlin & Winward 1982, Hironaka et al. 1983) Another commonly used sagebrush variety by sage grouse is *Ar. tr. va. pauciflora*. It has a fire frequency of 10-30 years and can return to 20% canopy cover in as little as 12 years (Tart 1996, Winward 1991). Density, cover and biomass of herbaceous species can be reduced when sagebrush cover exceeds 20% for a long period of time. Hironaka et al (1983), suggested a 10-20 year cycle of sagebrush manipulation if the objective is to maintain optimum amounts of forbs and grasses.

Long-term Management Objectives for *Ar. tr. va. vaseyana, & pauciflora*

- A general objective is to treat 15% of the treatable sagebrush community every five (5) years
(i.e. 75% of the area treated every 25 years.)
- 25% of the area untreated - in general and on a landscape scale approximately 25% of the area did
not historically lend itself to periodic burning (i.e. ridge tops, xeric sites, etc.).
- 10% of the area with 0-5% sagebrush crown cover and/or 0-10 yr. old plants - 25 % of the area with 5-15% crown cover and/or 10-20 yr. old plants
- 40 % of the area with > 15% crown cover and/or >20 yr. old plants
- maintain residual grass stubble height of 18 cm in all potential sage
grouse nesting sites
- maintain a mean of 25 -30 species of vascular plants in 5-15% crown cover category
- maintain ground cover >80% (except in recently treated areas - should be approaching 80% within
three years post treatment)

OBJECTIVES FOR SEASONAL SAGE GROUSE HABITATS

Treatment prescriptions must be carefully designed and tailored to the species, subspecies and varieties of sagebrush targeted. Existing vegetative composition and condition, as well as other potential influences, need to be assessed prior to treatment proposals. Factors such as grazing and/or noxious/exotic plant infestations may be impacting the site and limiting any potential benefits from prescribed burning. Prescribed fire is a tool best suited for returning sagebrush steppe communities to early seral states and does little to address other management Aproblems@. Prescribed fire treatments without such regard and long-term follow up management are recipes for failure. Moreover, prescribed fire treatments need measurable objectives for post-treatment vegetative composition/condition and agency commitment for long-term monitoring.

Treatments should be designed to maximize a mosaic of treated and untreated areas within the burn unit boundary. Individual blackened areas created within mosaics of large continuous sagebrush stands should normally not exceed 200 acres. Within delineated burn unit boundaries 40-60% of the burnable sagebrush should be burned with emphasis on a mosaic pattern. This point recognizes that about 25% of the area will not burn under most conditions. Unburned areas should be equal to or exceed burned areas in size over the landscape. Treatments conducted within 1/4 mile of a lek are discouraged and should only be conducted after intensive evaluation. In general, no more than 20% of the area within 2 miles of the lek should be treated unless the proposed treatment area has received a complete vegetative and seasonal sage grouse distribution inventory. Adjacent untreated areas should not be treated until treated areas have returned to potential sage grouse habitat. General guidelines for providing potential sage grouse habitat while maintaining sagebrush community health are:

- winter habitats - mosaic of height and cover classes with access to plants regardless of snow depths
  - where winter range appears limited, do not treat more than 30% of the range until treated sites provide available sagebrush forage (unless winter habitat appears to be limiting the population, in which case treat winter range only after a careful evaluation).
- nesting habitats - *vaseyana & pauciflora* - 15-25% canopy cover for
  - residual grass height of > 18 cm
  - sagebrush heights of 40-80cm
  - 20-35 vascular plant species in the stand(s)
- *wyomingensi*s -12-15 % canopy cover for
  - residual grass height of > 10 cm
  - 15 vascular plant species in the stand(s)
  - treat no more than 30% of available nesting habitat until treated sites have met the above nesting habitat requirements.
- brooding habitats- *wyomingensis* - 0-12% canopy cover for - mean of 15 vascular plants in the stand
- *vaseyana & pauciflora* - 0-15% canopy cover for
  - *vaseyana* stands - mean of 35 vascular plants
  - *pauciflora* stands - mean of 20 vascular plants -

GRAZING MANAGEMENT

Post-treatment management of livestock grazing, both short and long-term, is essential for maintenance of optimum sagebrush canopy cover and herbaceous understory. There is no point in expending resources on prescribed fire projects without commitment to long-term livestock grazing management. In the viewpoint of many sage grouse managers, domestic livestock grazing practices have often left insufficient residual grass cover to promote successful nesting and brood rearing habitat which has impacted grouse populations, particularly in the recent drought years. Crawford et al. (1992) found that domestic livestock grazing potentially has the greatest impact on sage grouse habitat because it remains the most common and widespread use of rangelands and is the principal land management practice that effects herbaceous composition, cover, and height. Livestock grazing also affects sagebrush density, canopy cover, and reinvasion rates (Goodrich et al. 1998, Bennett 1992) . Grazing may reduce fine fuels to such an extent that Anatural fire intervals are no longer maintained, further exacerbating the condition and health of the area. Sage grouse populations are most likely regulated by habitat condition and availability, both of which can be significantly effected by livestock grazing practices.

Riparian areas, which are critical brood-rearing areas and summer use areas, especially in low precipitation zones and/or during periods of drought conditions, commonly receive excessive livestock grazing. Recommended residual stubble heights for meadows and riparian areas in

various conditions are; 4-6@ for areas in excellent condition, 6-8 inches for areas in good condition, and long-term rest for areas in poor condition. Hall and Bryant (1995) reported that as stubble heights approached three (3) inches for most palatable species grazed by cattle, forage preference will change and unacceptable grazing patterns will begin. Conversely, moderate grazing may increase forb production and availability in upland meadows during late summer (Klebenow 1985, Evans 1986).

Heath (1997) recommended maintaining an average residual grass stubble height between 10-15 cm for potential nesting habitat within *Ar. tr. wyomingensis* in southwest Wyoming. Crawford (1992) and Gregg et al. (1994) recommend a residual grass stubble height of > 18 cm in *Ar. tr. vaseyana.*

There is a strong need for land management agencies to make appropriate grazing adjustments during drought conditions. Bennett (1992) found that stocking rates were not adjusted in Wyoming for recurring drought cycles. During the notorious drought of the 1930=s, livestock numbers actually increased. The combined impact of improper grazing and drought conditions are thought to have had an exponential impact on sagebrush community composition, diversity, and structure.

Vacant allotments should not be immediately restocked. An analysis of range conditions, livestock management problems, and wildlife/grazing conflicts and opportunities should be completed and incorporated into revised allotment management plans prior to restocking. Some vacant allotments should be maintained as relief or rest pastures during drought conditions for other active allotments. These allotments can serve as critical, short term alternative grazing allotments where livestock can be moved to accommodate habitat enhancements (or simply rest) in occupied allotments. Landscape-scale habitat enhancements simply will not be possible without providing alternative grazing sites for permittees on public grazing lands. Moreover, long-term follow-up grazing management will be critical to meet and maintain sagebrush community vegetation objectives into the future.

The recommendation for 18 cm (7 in) of cover for nesting should clarify that this is cover available at the initiation of nesting, which consists almost entirely of residual cover in Wyoming and only minor amounts of current year=s spring growth. In order to achieve this goal, the residual cover requirement may need to be met at the conclusion of the previous year=s growing season. This implies grazing management strategies that will leave adequate residual vegetation regardless of the season of use. Currently, grazing management plans do not contain this criteria and proper use criteria in allotment management plans often will not achieve this goal. Current direction to improve riparian habitat and properly manage grazing in this key habitat focuses more livestock use in the uplands . This strategy may compromise efforts to maintain adequate residual vegetation for sage grouse nesting habitat unless both management goals are recognized in the allotment management plans.

Recommendations for season and timing of grazing are also important. Bennett (1992) recommended domestic sheep grazing on grouse nesting areas be delayed until the first week of June. Heath (1996) felt sheep grazing may have been more conducive to sage grouse productivity than cattle grazing in his study area, because sheep grazed for shorter periods of time, during different seasons, and utilized vegetation differently than cattle. Cattle moderately or intensively use specific sites for longer periods of time.

CONCLUSION

In Wyoming there is a large amount of sagebrush within the core area of the range of the sage grouse that consists of overmature or decadent stands of relatively even age classes (sagebrush monocultures). Protecting such areas does little to benefit sage grouse early brood rearing habitat and eventually nesting habitat if there is little herbaceous vegetation (and presumably insects) in the understory. The apparent lack of forbs and insects under dense, mature sagebrush stands may be a major bottleneck to local sage grouse populations. These stands of sagebrush often have relatively low levels of grasses and forbs in the understory compared to more open stands with lower canopy coverage, which are more typical of mid-seral sagebrush communities.

Active management of the dynamic sagebrush and associated vegetative communities is essential for the long-term maintenance of an array of terrestrial and aquatic fauna species. Maintaining dynamic sagebrush communities in a late seral static state does little to benefit the myriad of flora and fauna species so dependent on a mosaic of seral states of sagebrush and its associated communities. We may have to accept some short-term reductions (over 10-20 years) in habitat productivity for sage grouse in order to overcome the cumulative effect of decades of mismanagement of the sagebrush-grassland ecosystem. This is a trade-off we should be willing to accept in order to reverse the accumulated effect of decades of fire suppression and inappropriate grazing management.

Treatment prescriptions must be carefully designed and tailored to the species, subspecies and varieties of sagebrush targeted. Prior to proposing prescribed fire treatments, sites must be adequately inventoried to determine existing condition and vegetative composition. Secondly, post-treatment vegetative objectives need to be established. Lastly, agency commitment to long-term post-treatment monitoring of objectives is necessary to determine project success/failure and fine-tune future treatments. It is imperative that agency personnel coordinate and plan sagebrush treatments and management needs very well at the local level.

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